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ABSTRACT

The course provides skills in the use of tools and procedures for the alignment of automotive body damage. Course content includes goals, specific objectives, orientation, service tools and bench skills, and body construction. Also studied are collision damage, aligning body shell and components, and replacement of sheet metal parts. A bibliography and post-test are appended. A prerequisite for this course is mastery of the skills covered in the course "Automotive Body Sheet Metal Maintenance 2". (NH)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

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Course Outline
AUTO BODY REPAIR AND REFINISHING 2 - 9035
(Body Shell Alignment)
Department 48 - Quin 9035.02

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

AUTO BODY REPAIR AND REFINISHING 2 - 9035
(Body Shell Alignment)

Department 48 - Quin 9035.02

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

July, 1973

Published by the School Board of Dade County

Course Description

9035	48	9035.02	Body Shell Alignment
State Category Number	County Dept. Number	County Course Number	Course Title

Training experiences provide skills in the use of tools and procedures for the alignment of automotive body damage. Manufacturer's manuals are utilized in all practical applications to insure the usage of correct tools and measurements relating to repair. This is a two or three quinmester credit course. This course will be given in a 9 week period.

Indicators of success: the applicant must demonstrate an eighth grade equivalency score in reading and math. Also have average ability in mechanical aptitudes.

Clock Hours: 135

PREFACE

The following quinmester course outline is a guide to help students become employable with skills, knowledge, attitudes and values necessary for performing the required services of the automotive body shell alignment repair trainee.

This course is designed as a foundation quinmester course for the auto body repair trainee. This outline consists of 7 blocks of instructions which are subdivided into several units each. It is only one part of a series of quinmester outlines designed for the complete auto body repair trainee. This course is 135 hours in length.

Prerequisites for this course is as follows: the student should have an eighth grade equivalency score in reading comprehension, arithmetic fundamentals and mechanical aptitude. The student must be physically and mentally able to profit from this training.

Prior to entry into this course, the vocational student will display mastery of skills indicated in Automotive Body Sheet Metal Maintenance II (9035.01).

Instruction will consist of demonstrations, lectures, group discussions, audio visual aids, and resource people from industry. Instruction will be flexible to meet individual needs and abilities.

The bibliography appearing on the last page of this outline lists several basic references, also supplementary references and audio visual aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee and the Vocational Curriculum Materials Service and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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BLOCK

I. ORIENTATION (5 Hours)
- Objectives of Course . . . 1
- Students Benefits . . . 1
- Student Responsibilities . . . 1

II. SERVICE TOOLS AND BENCH SKILLS (5 Hours)
- Automotive Hand Tools . . . 1
- Power Tools . . . 2
- Measuring Devices and Their Use . . . 2

III. BODY CONSTRUCTION (5 Hours)
- Manufacture . . . 2
- Manufacturing Methods . . . 2
- Assembly Methods . . . 2

IV. COLLISION DAMAGE (5 Hours)
- Types of Collision . . . 3
- Misalignment of Body and Components . . . 3
- Diagnosing Body Damage . . . 3

V. ALIGNING BODY SHELL AND COMPONENTS (65 Hours)
- Unitized or Conventional Frame and Body . . . 4
- Rear End Collision . . . 4
- Front End Collision . . . 4
- Head on Collision, Side Damage . . . 4
- Roll Over or Upset . . . 5

VI. REPLACEMENT OF SHEET METAL PARTS (50 Hours)
- Remove and Replace Front Fender . . . 6
- Door Outer Panel Replacement . . . 6
- Replace Quarter Panel . . . 6
- Replace Rear Body Panel . . . 6
- Replace Rear Compartment Cover . . . 6
- Replace Rocker Panel . . . 6
- Replace Body Lock Pillars . . . 7
- Replace Roof Panel . . . 7

VII. QUINMESTER POST-TEST

APPENDIX: QUINMESTER POST-TEST SAMPLE . . . 13

GOALS

The auto body repair trainee must be able to demonstrate:

1. The skills and knowledge to select and use tools and equipment of the auto body trade.

2. The skills and knowledge to identify and name the types of automobile and construction materials and their function.

3. The ability to diagnose correctly collision damange to the automobile body.

4. The ability to align and repair collision damage to the automobile body.

5. The ability to align, remove and install new sheet metal parts.

6. Pride and respect of craftmanship for this occupational field.

7. Positive attitude regarding the value and dignity of work.

8. Safe work habits and proper shop behavior to guard against accidents.

9. An incentive to continue with more advanced training within the occupational field.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - ORIENTATION

The student must be able to:

1. List the opportunities that are available for career in the auto body and refinishing occupational field by written assignment.
2. State what will be expected of him as an auto body repair trainee by oral or written test.
3. Demostrate skills and knowledge which will prepare him for a safe working life by actual shop practice.
4. Demonstrate an understanding of shop organization by written assignment.
5. Demonstrate pride and respect for workmanship by his performance.
6. Demonstrate understanding and acceptance of personal responsibilities by his actions in classroom or laboratory.

BLOCK II - SERVICE TOOLS AND BENCH SKILLS

The student must be able to:

1. Define the general type of tools and their use by written test.
2. Exhibit the ability to use the applicable tools and perform bench skills in proper manner by selection and use.
3. Demonstrate the proper care and maintenance of tools and equipment by following written instructions.
4. Exhibit the ability to observe safety precautions in the use of tools and equipment by his performance in laboratory.
5. Exhibit the ability to identify power tools and equipment by study of text and manuals.
6. Demonstrate the ability to perform maintenance and repairs to power tools by shop performance.
7. Exhibit the ability to practice safet precautions by observing safety rules.
8. Demonstrate the ability to use measuring devices by actual shop practices.

BLOCK III - BODY CONSTRUCTION

The student must be able to:

1. Demonstrate the ability to identify types of body construction by written assignment.
2. Exhibit the ability to identify types of material by testing methods.
3. Demonstrate the ability to list manufacturing methods by written test.
4. List the methods of assembly by written assignment.

BLOCK IV - COLLISION DAMAGE

The student must be able to:

1. Demonstrate the ability to identify types of collision by actual observance.
2. Explain the effects of collision damage by written description.
3. Determine extent of related damage by written assignment.
4. List misalignment damage to body shell by written assignment.
5. Determine extent of damage to the unitized frame assembly by use of gauges.
6. Diagnose collision damage to automobile by use of gauges and visual inspection.

BLOCK V - ALIGNING BODY SHELL AND COMPONENTS

The student must be able to:

1. Exhibit the ability to operate the portable or stationary body and frame machine by actual shop performance.
2. Demonstrate the ability to repair collision damage to rear of automobile by performing necessary operations.
3. Exhibit the ability to follow sequential procedures of repairs by oral instructions.
4. Demonstrate the ability to repair front end collision repairs to automobile by use of power equipment.
5. Determine extent of related damage by visual inspection.
6. Exhibit the ability to follow sequential procedures by oral instructions.
7. Demonstrate the ability to repair side collision damage by selection and use of proper equipment.
8. Determine extent of related damage by visual inspection.
9. Exhibit the ability to follow sequential procedures by oral instruction.
10. Demonstrate the ability to align and repair roll over or upset collision damage by use of hand tools and power equipment.
11. Determine related damage by visual inspection.
12. Exhibit the ability to follow sequential procedures by oral instructions.

BLOCK VI- REPLACEMENT OF SHEET METAL PARTS

The student must be able to:

1. Remove, replace and align front fenders by actual performance.
2. Remove door and install new outer panel by following written instructions.
3. Reinstall and align door by actual performance.
4. Align damaged quarter panel, remove old panel and install new panel by actual performance.
5. Align rear body panel, remove old panel and install new panel by actual performance.
6. Remove old rear compartment cover, install new panel and align by following oral instructions and performance.

VI - REPLACEMENT OF SHEET METAL PARTS (Contd.)

7. Align damaged rocker panel, remove and install new panel by following oral instructions and performance.
8. Align damaged body lock pillar, remove and replace new pillar by actual performance.
9. Align roof panel headers, windshield pillars and reinforcements and roof panel, install new panel by sutdy of text, and instructions and actual performance.

VII - QUINMESTER POST TEST

The student must be able to:

1. Satisfactorily complete the quinmester post test by written assignment.

Course Outline

AUTO BODY REPAIR AND REFINISHING 2 - 9035
(Body Shell Alignment)

Department 48 - Quin 9035.02

I. ORIENTATION

A. Objectives of Course
   1. Standards
   2. Methods of evaluation
      a. Manipulation
      b. Written test
      c. Oral test
      d. Diagnosis and job performance
   3. Teaching methods
   4. Safety

B. Student Benefits
   1. Qualification for Employment
      a. Attitudes
      b. Dependability
      c. Job competency
      d. Pride of workmanship
      e. Experience
      f. Trade certificate
      g. Foundation for more education and training
   2. Opportunities for employment
      a. Job opportunities
      b. Scope of trade

C. Student responsibilities
   1. Shop rules and procedures
   2. School policies and expenses
   3. Safety regulations
      a. Care of hand tools
      b. Use and care of equipment
      c. Appropriate dress
      d. Housekeeping
      e. Materials and supplies
      f. Reporting defective equipment
      g. Reporting loss of equipment
      h. Employee-employer relations
      i. Employee-customer relations

II. SERVICE TOOLS AND BENCH SKILLS

A. Automotive Hand Tools
   1. Types and sizes
   2. Uses and safety precautions
      a. Hammers
      b. Dollies

II. SERVICE TOOLS AND BENCH SKILLS (Contd.)

c. Spoons
d. Files
e. Wrenches
f. Hack saw
g. Plier
h. C lamps
i. Vises
j. Taps and dies
k. Soldering tools

B. Power Tools
1. Types and sizes
2. Maintenance
3. Use and safety precautions
a. Drills
b. Sanders
c. Hydraulic jacks
d. Air hammer
e. Arbor Press
f. Lifting devises

C. Measuring Devises and Their Use
1. Care and maintenance
2. Safety precautions
a. Steel tape
b. Tram gauge
c. Center line gauge

III. BODY CONSTRUCTION

A. Manufacture
1. Types
2. Materials
a. Angles
b. Box
c. U Channel
d. Z Stock
e. Steel
f. Aluminum
3. Manufacturing methods
a. Molded
b. Stamped
c. Drawn
d. Pressed

B. Assembly methods
1. Types
2. Materials
a. Electric spot weld
b. Oxy-acetylene Gas weld

III. BODY CONSTRUCTION (Contd.)

c. Electric arc weld
d. Brazing
e. Rivets
f. Bolts
g. Screws

IV. COLLISION DAMAGE

A. Types of Collision
1. Effects of impact
a. Upset
b. Rear end
c. Side swipe
d. Roll
e. Front end
f. Speed
g. Direction
h. Impact of object
2. Related damage
a. Cowl
b. Doors
c. Windshield
d. Roof panel
e. Floor panels
f. Seat adjusters
g. Instrument panels

B. Misalignment of Body and Components
1. Body shell
2. Unitized frame assembly
a. Hood and hinges
b. Fenders
c. Doors and hinges
d. Trunk lid and hinges
e. Windshield
f. Back glass

C. Diagnosing Body Damage
1. Visual inspection
2. Comparative measurements
a. Point of impact
b. Direction of impact
c. Related components
d. Related damage
e. Year and manufacturer
f. Model
g. Manufacturer's manual
h. Unitized frame and body
i. Conventional frame and body

V. ALIGNING BODY SHELL AND COMPONENTS

A. Unitized or Conventional Frame and Body
   1. Portable frame and body machine
   2. Stationary rack or pit frame machine
      a. Type and manufacturer
      b. Manufacturer's chart and manual
      c. Power jacks
      d. Methods of anchoring
      e. Chains
      f. Oxy-acetylene torch
      g. Heating methods
      h. Hand tools
      i. Power pull

B. Rear End Collision
   1. Direct damage
      a. Rear bumper
      b. Rear body panel
      c. Rear compartment lid
      d. Quarter panels
      e. Floor panels
   2. Repair procedures
      a. Remove bumper
      b. Use external pulling equipment
      c. Pull and align floor panel
      d. Pull and align rear body panel
      e. Pull and align quarter panels
      f. Align rear compartment cover opening
      g. Repair and align rear compartment cover

C. Front End Collision
   1. Direct damage
      a. Front bumper
      b. Front fenders
      c. Radiator grille
      d. Hood
   2. Related damage
      a. Front door alignment
      b. Cowl assembly
      c. Fire wall
   3. Repair procedures
      a. Remove bumper
      b. Use external pulling equipment
      c. Pull and align fenders
      d. Pull and align hood
      e. Pull and align cowl and firewall
      f. Align doors and hinges

D. Head on Collision Side Damage
   1. Direct Damage
      a. Doors
      b. Lock pillars
      c. Quarter panel
      d. Rocker panel

V. ALIGNING BODY SHELL AND COMPONENTS (Contd.)

2. Related damage
   a. Floor panels
   b. Inner construction
   c. Seats
3. Repair procedures
   a. Use of pulling equipment
   b. Pull rocker panel and floor panel
   c. Push or pull body lock pillars
   d. Repair and align door or doors
   e. Repair and align quarter panel

E. Roll Over or Upset
1. Direct damage
   a. Roof panel
   b. Windshield pillars
   c. Side roof rails
   d. Lock pillars
   e. Back glass openings
   f. Doors
   g. Cowl
2. Related damage
   a. Inner construction
   b. Seats and upholstery
   c. Glass
3. Repair procedures
   a. Use of internal jacks
   b. Use of external pull jacks
   c. Push or pull windshield pillars
   d. Push or pull body lock pillars
   e. Use of heat to relieve strain
   f. Use of measuring devices to check alignment
   g. Reform damaged metal
   h. Use windshield and back glass to check openings
   i. repair and align doors

VI. REPLACEMENT OF SHEET METAL PARTS

A. Remove and Replace Front Fender
1. Bolt on type, year and model
   a. Align fender and components
   b. Remove necessary related parts
   c. Remove bolts
   d. Remove fender
   e. Straighten inner panel
   f. Align and weld new fender

B. Door Outer Panel Replacement
1. Type and manufacturer

2. Year and model
   a. Remove door
   b. Grind edges of door panel
   c. Cut necessary welds
   d. Remove panel from door
   e. Straighten inner panel
   f. Install and fit new door panel
   g. Fold edges of new panel
   h. Install door assembly
   i. Realign door
   j. Spot weld or braze new panel to inner panel

C. Replace Quarter Panel
   1. Type and manufacturer
   2. Year and Model
      a. Align existing panel and related parts
      b. Cut panel from body
      c. Straighten inner construction
      d. Install and align new panel
      e. Tack weld new panel
      f. Complete welding or brazing
      g. Grind and fill welds
      h. Sand and metal finish

D. Replace Rear Body Panel
   1. Type and manufacturer
   2. Year and model
      a. Remove bumper
      b. Align existing panel and related parts
      c. Cut spot welds
      d. Remove panel
      e. Straighten floor panels
      f. Install and fit new panel
      g. Weld or braze as necessary
      h. Grind and fill welds
      i. Sand and metal finish

E. Replace Rear Compartment Cover
   1. Type and manufacturer
   2. Year and model
      a. Remove existing compartment cover
      b. Install and align new compartment cover
      c. Install moldings and hardware
      d. Install and adjust lock and striker

F. Replace Rocker Panel
   1. Type and manufacturer
   2. Year and Model
      a. Align existing panel and related parts
      b. Cut welds and remove panels
      c. Straighten floor and inner panel

VI. REPLACEMENT OF SHEET METAL PARTS (Contd.)

d. Install and weld new panel
e. Grind and fill welds
f. Sand and metal finish

G. Replace Body Lock Pillars
1. Type and manufacturer
2. Year and model
a. Align existing pillar and related parts
b. Cut welds and remove pillar
c. Install and weld new pillar
d. Grind and fill welds
e. Sand and metal finish

H. Replace Roof Panel
1. Type and manufacturer
2. Year and model
a. Align and rough out existing panel and related parts
b. Remove necessary interior upholstery and glass
c. Install and align new panel
d. Cut welds and remove old panel
e. Spot weld or braze new panel to roof headers
f. Grind and fill welds
g. Sand and metal finish
h. Replace glass, hardware and upholstery

VII. QUINMESTER POST-TEST

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1. Frazer, Irving, and Others. Automotive Collision Work. Chicago: American Technical Society, 1953. Pp. 343.

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4. Liskey, George W. and Depew, Harry M. Body Frame Dimnesion Charts. Lansin, Michigan: Truway Company, 1970. n.p.

5. Tabolt, Bill. Auto Body Repairing and Painting. Homewood: Goodheart-Willcox Co., 1965. Pp. 224.

Films:	Dade County No.
1. ABC of Hand Tools Part I. 16 mm. 18 min. Color. Sound. General Motors.	1-11397
2. ABC of Hand Tools Part II. 16 mm. 16 min. Color. Sound. General Motors.	1-11399
3. Accidents Happen to Sam. 16 mm. 13 min. B/W Sound. National Safety.	1-11339
4. I Want a Job. 16 mm. 26 min. B/W Sound. Ford Motor Company	1-11568

A P P E N D I X

Quinmester Post-Test Sample

QUINMESTER POST TEST

Name _____ Date _____ Score _____

I. The following items are multiple choice. Circle the letter opposite the word or phrases you believe correct.

1. Dolly blocks are made in various shapes and crowns to:

   a. Make them easier to hold
   b. Cut down weight
   c. Fit the different crowns of metal
   d. Make them more streamlined

2. Spoons are used:

   a. As dolly blocks
   b. As prying or driving tools
   c. For spreading the force of hammer blow over larger areas
   d. All of the above

3. A pick hammer should be used for:

   a. Shrinking metal
   b. Roughing out work
   c. Working out minor dents
   d. Low crown panel damage only

4. A dolly block is used as a:

   a. Striking tool
   b. Back up tool for pick hammer
   c. Back up tool for the bumping hammer
   d. Both 1 and 3 are correct

5. A "Low Crown" panel on an automobile:

   a. Has much curvature resulting in round shape
   b. Can never be spot welded
   c. Has very little curvature
   d. Does not need reinforcing by flanges

6. If a roof panel is to be replaced, the best results can be accomplished by first:

   a. Cutting the existing roof panel off
   b. Cutting the damaged pillars and headers off with roof panel
   c. Aligning and straightening the body pillars and reinforcements before cutting roof off
   d. Either of the above methods give equal results

7. The oxy-acetylene torch is used to heat severely damaged pillars and reinforcements to:

   a. Temper the metal
   b. Stretch shortened metal
   c. Soften and anneal work hardened metal
   d. Oxidize metal to remove excess carbon

8. Which heat indicated by color should be used to anneal metal?

   a. White
   b. Blue
   c. Cherry-red
   d. Orange-yellow

9. The type of flame used to anneal metal is:

   a. Carburizing flame
   b. Oxidizing flame
   c. Neutral flame
   d. None of the above

10. Door alignment can be accomplished by adjusting hinges:

   a. Backward or forward
   b. In or out
   c. Up or down
   d. All of the above

11. The unitized body and frame is different from the convential body and frame because:

   a. The conventional body and frame is riveted together
   b. The unitized body and frame is welded together
   c. The unitized body and frame is bolted together
   d. The unitized body and frame is riveted together

12. In checking body shell alignment the following item is best:

   a. Length of string
   b. Tram gauge
   c. Steel tape
   d. Center line gauge

13. Hydraulic jacks used in auto body repairs are considered better than mechanical jacks because:

   a. They are more powerful
   b. Less expensive
   c. Requires less care
   d. All of the above

14. A portable frame machine can be used to:

a. Straighten frame
b. Straighten and align body pillars
c. Straighten doors
d. All of the above

15. Hydraulic body jacks are used to:

a. Relieve pressure on metal
b. Align body pillars
c. Align body shell
d. All of the above

16. When repairing the unitized frame and body, the frame and body must be repaired:

a. As a single unit
b. Separately
c. By removing all damaged sheet metal first
d. None of the above is correct

17. In the assembly of auto body panels at the factory, the major part of welding is done by:

a. Micro-wire welder
b. Oxy-acetylene torch
c. Electric spot welder
d. Electric arc welder

18. Blocks of 2" x 4" or 2" x 6" are used to:

a. Spread force of jack over larger area
b. Avoid damage to metal
c. Raise and align door
d. All of the above.

19. Center line gauges are used to:

a. Make diagonal check of frame
b. Make center line check of frame
c. Make datum line check of frame
d. Check body shell alignment

20. The type of material from which the automobile body is made is:

a. U channel
b. Box channel
c. Angle
d. All of the above

21. A door that is in too far at bottom and out too far at top can be aligned by:

    a. Adjusting both hinges forward
    b. Adjusting top hinges forward
    c. Adjusting lower hinge outward and top hinge in
    d. Adjusting both hinges up

22. Rear compartment covers are adjusted by:

    a. Moving forward
    b. Moving backward
    c. Moving right or left
    d. All of the above

23. The door strikers adjust in and out, up and down; when aligning door it is advisable to:

    a. Loosen striker
    b. Adjust striker in as far as possible
    c. Adjust striker out as far as possible
    d. Remove striker until door is aligned

24. The fittings on most hydraulic bodyjacks are threaded. When replacing pipe or fittings they should be:

    a. Tightened by hand
    b. Tightened with pipe wrench
    c. Screwed on with only enough threads to hold
    d. Either of above method satisfactory.

25. A fender that has been driven backward forming a severe bucked on the side is held in this position by:

    a. Compression
    b. Elasticity
    c. Tension
    d. Work hardening

26. When a new fender is installed, the critical alignment points are:

    a. Spacing between fender and door
    b. Spacing between fender and hood
    c. Spacing between fender and cowl
    d. All of the above

27. On a welded type fender, the major welding at factory is:

    a. Oxy-acetylene gas weld
    b. Electric spot weld
    c. Electric arc weld
    d. heliarc

28. When aligning a door the hinges are adjustable:

a. Up or down
b. In or out
c. Fore and aft
d. All of the above

29. When installing a door the latch striker should be:

a. Removed
b. Moved out as far as possible
c. Moved in as far as possible
d. Leave as it is

30. When cutting a quarter panel off always cut at factory joints or:

a. Replace only damaged part
b. Cut where heat distortion is the least
c. Location of cut immaterial
d. All of the above

31. Rear compartment cover hinges are adjustable:

a. Forward
b. Backward
c. Right or left
d. All of the above

32. When a roof panel is replaced the best procedure is to:

a. Remove existing panel before aligning
b. Align body shell, doors and glass openings
c. Cut roof headers off with roof panel
d. None of the above

33. When aligning windshield openings the best method of measurement is to use:

a. Tram gauge
b. Length of string
c. Telescopic gauge
d. Center line gauge

ANSWER KEY TO QUINMESTER POST-TEST

1. c
2. d
3. c
4. d
5. c
6. c
7. c
8. c
9. c
10. d
11. b
12. b
13. a
14. d
15. d
16. a
17. c
18. d
19. b
20. d
21. c
22. d
23. d
24. a
25. a
26. d
27. b
28. d
29. a
30. b
31. d
32. b
33. c